

Correlation between Work Duration and Work Posture with Musculoskeletal Disorders Symptoms in Interior Design Students at Campus Biru Surakarta

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Abstract. The activities of interior design students, namely drawing objects and drawing techniques, require a high level of accuracy and concentration, these activities have an impact on health problems such as muscle injury. Musculoskeletal disorders are one of the symptom often felt by interior design students. This study is to determine the relationship between work duration and student work posture with MSDs symptoms. Methods: This study used observational analytics with a cross sectional design. The research respondents were 66 of 2nd semester interior design students used random sampling technique. The research instrument used the REBA method to assess work posture, and the NBM questionnaire to assess musculoskeletal disorder symptom. Data analysis with Pearson Product Moment test and Multiple Linear Regression. Results: The results showed a significant relationship between work duration and MSDs symptoms (p -value 0.000), positive correlation direction and moderate level (0.509). while the significant relationship between work posture and MSDs symptoms (0.000), positive correlation direction and strong level (0.638). Multivariate test results stated significant (0.000) with a positive correlation direction. Work posture has the highest correlation with MSDs symptoms with a proportion of 62%. Conclusion: There was correlation between work duration and work posture with MSDs symptoms of interior design students at Campus Biru Surakarta.

Keywords: Work Duration, Work Posture, Interior Design, MSDs Symptoms.

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1 Introduction

Musculoskeletal Disorders (MSDs) occur when the physical abilities of workers do not match the physical demands of their work attacking the muscles which are diseases or disorders of soft tissues including muscles, joints, ligaments, tendons and cartilage as well as the nervous system. Prolonged exposure to ergonomic risk factors can cause damage to the body [1]. According to Peter Vi in Tarwaka factors cause the emergence of musculoskeletal symptom in the form of excessive muscle stretching (overexertion), repetitive activities, unnatural work attitudes [2].

MSDs is a complaint in the skeletal muscles that a person feels ranging from mild to severe symptom and cause damage to joints, ligaments and tendons [3]. World Health Organization based on data approximately 1.71 billion people have MSDs worldwide [4]. Among musculoskeletal disorders, lower back pain causes the highest number with a prevalence of 568 million people [5].

Length of work is the accumulation of time exposed to risk factors. The length of working time is 7 hours for 6 working days in a week or 8 hours for 5 working days in a week, if it exceeds, occupational diseases will occur [6]. While work posture is an important thing that must be considered in a job, because it can affect the health of the body. Often a person when working is found in a state of unnatural working posture when doing work without caring about the impact of the situation. Unnatural working posture is one of the factors that cause the risk of MSDs symptoms [7].

One type of activity or work that has a risk of MSDs symptom is students because they have activities and conditions that risk unnatural working postures for a long time or repeatedly. Improper ergonomic conditions such as learning attitudes, table shapes and lecture tools that are less suitable trigger musculoskeletal symptom [8]. Unergonomicity in work can cause the risk of musculoskeletal disorders in the form of back pain, neck pain, wrist pain, elbows and feet [9,10].

Faculty of Fine Arts and design, especially students of interior design semester 2 in drawing objects and drawing techniques class that are carried out in one semester and are repetitive work actions that can trigger symptom of pain when doing these activities with working postures such as sitting for a long time, bending, and twisting for 4-6 hours/day.

The initial data of study on 10 Interior Design students in semester 2 were known to have MSDs symptom in low risk category, there were 3 students while the high risk was 7 students, for long work <4 hours/day there were 4 students and long work >4 hours/day as many as 6 people. Work posture in 5 students obtained a final score of 3 including the low category there were 2 students and the final score of 7 as many as 3 students in the medium category. Based on these data, the researchers conducted further analysis related to the relationship of work duration and work posture with MSDs symptom on interior design students at campus biru Surakarta.

2 Methods

This study uses observational analytics with cross sectional research design to study the dynamics of the correlation between risk factors with effects, by approach, observation or data collection at once at a time [11].

The population in this study were all interior design students semester 2 Campus Biru Surakarta amounted to 105 people, while the sample was 66 people using sampling techniques is random sampling. The independent variable of this study is the work duration and work posture while the dependent variable is symptom musculoskeletal disorder (MSDs). The research instruments used the Rapid Entire Body Assessment (REBA) method in the assessment of working posture, and the Nordic Body Map (NBM) questionnaire for

the assessment of MSDs symptom. Data analysis with Pearson Product Moment test and multiple linear regression test.

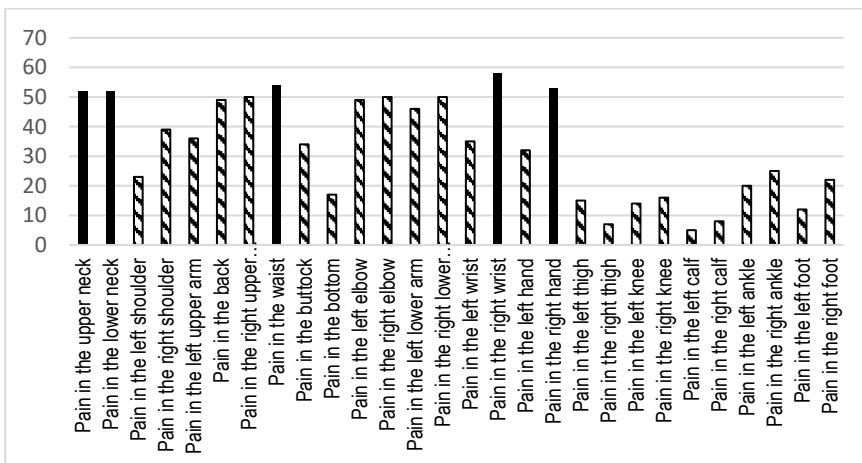
3 Results

Characteristics of respondents in the study showed that students of interior design semester 2 Campus Biru Surakarta, included in the productive age of all (100%), with more dominant female (63.63%) and normal BMI student (84.84%) results seen in following the table.1:

Table 1. Results of Research Data Collection of Respondents

Data		n	%
Age	Produktive	66	100
	Non Produktive	0	0
Gender	Female	42	63,63
	Male	24	36,37
BMI	Normal	56	84,84
	Abnormal	10	15,16
Work Duration	<4 hours/day	44	66,67
	>4 hours/day	22	33,33
Work Posture	Low	16	24,24
	High	50	75,76
MSDs symptom	No	18	27,28
	Yess	48	72,72

The research data based on the table.1 in the form of work duration namely 66.67% less than 4 hours/day, while for the working posture of respondents using the REBA method showed that 75.76% were at high risk. MSDs symptom assessment results respondents experienced many symptoms as much as 72.72%.



Picture 1. MSDs Respondent Symptom Assessment Diagram
Source: Primary Data, 2023

MSDs symptom assessment of respondents in picture 1 shows that there are 5 high-risk symptom, among others: 1. right wrist (87%); 2. waist (81%); 3. right hand (80%); 4. upper neck (78%) and 5. lower neck (78%).

Table 2. Test Results of Variable Data Research

Variable	MSDs Symtomp		n	Bivariat Test		Coefficient of Determination		
	No	Yes		Sig-(p)	Corelation (r)	Model	R-Square	Sig-
Work Duration						1	0,551	0,000
<4 hours/day	10	34	44	0,000	0,507			
>4 hours/day	8	14	22					
Work Posture								
Low	9	7	16	0,000	0,637			
High	9	41	50					
N			66					

Based on the Table.2 The results of the Pearson Product Moment Test to determine the relationship of service life with symptom of musculoskeletal disorder (MSDs) obtained the value of p (value) = 0.000 ($p < 0.05$) which means significant in the direction of positive correlation with the value (r) 0.507. While the test results to determine the relationship of work posture with symptom of MSDs obtained the value of p (value) = 0.001 ($p < 0.05$) which means significant in the direction of positive correlation with the value (r) 0.637.

The results of the relationship test of wor duration, work posture with MSDs symptom using multiple linear regression test and normality of normally distributed data with results of 0.651 > 0.05 . In addition to the classical assumption test, there is also a feasibility test model in which there is a reliability test Model (F test) with the results of the value of p (value) 0.000 which means < 0.005 , the results of the regression coefficient test (T-Test) is the p-value for the length of work and work posture is 0.000 < 0.05 , while for the coefficient of determination obtained R-Square 0.551 which means the work duration and work posture affect the MSDs of 55.1% can be seen in Table 2.

Based on the results of multiple linear regression test with Model Interpretation obtained by the increase in work duration 1 unit will increase MSDs symptom by 2.204 units and vice versa and the increase in work posture 1 unit will increase MSDs symptom by 3.787. So, it can be stated that the variables of wor posture have a partially significant influence on MSDs symptom.

4 Discussion

The results of the research data showed that all respondents aged 17-25 years were teenagers. According to Villa-Forte [12] at the age of about 30 years, bone density begins to decline in women. Muscle loss (sarcopenia) is a process that begins around the age of 30 and lasts throughout life. In this process, the total amount of muscle tissue and the total size of muscle fibers gradually decrease. In line according to Marcilin & Situngkir's research, that with the increase of a person, the decrease in bone strength increases. This situation occurs when a person is 30 years old, because at this age tissue damage occurs, degeneration such as scar tissue replacement (healing process or injury), dehydration occurs, and bone-muscle are reduced [13]. The Data of this study respondents age less than 30 years who have not experienced muscle injury disorders, in line with the theory of Suma'mur [14] which says that muscle strength is influenced by the age of one of them, at the age of 50-60 years will experience a decrease in muscle strength of 25% and a decrease in sensory 60%.

Respondents in this study were more female (63.36%), this is in accordance with the opinion of Silverstein et al [15] that women have a higher risk of hand and wrist injuries than men. It is also influenced by hormonal differences between women and men [16]. Despite this according to Tarwaka [2] has conducted research on the static muscle strength of men

and women between the ages of 20-60 years, muscle strength occurs at the age of 20-29 years and then continues to decline with age. At the age of 60, the average muscle strength decreased by 20%, so the respondents in this study either men or women have the same muscle strength.

The Body Mass Index of respondents was 84.84% in the normal category, so this is related with the theory [17] that musculoskeletal system symptom related to body size are more caused by the balance condition of the skeletal structure in receiving loads, both body weight and other additional loads and according to Sujono [18] has a relatively small influence, weight, height and body mass are factors that can cause symptom of the musculoskeletal system.

Respondents as many as 66.67% have long worked for <4 hours every day. According to Manuaba [19] which states that the work duration affects MSDs more on jobs that require great exertion. It is the same [20] states that MSDs symptom can increase, if the activity is carried out repeatedly and continuously and doing monotonous work will cause interference with the body's muscles. Physical stress can also affect muscle performance, because stress causes a health disorder of the body known as Musculoskeletal fatigue. Research in line by [21] about the relationship between musculoskeletal pain with work station conditions and size, as well as the position of the farmer's body, one of which is the length of work which shows a relationship between the duration of work of farmers with musculoskeletal symptom. Students in this study are all required to follow learning activities on schedule in 1 semester, so that all experience the same workload.

The results of the assessment of work posture according to the table.1 has a high risk of 75.76% and REBA assessment data obtained not ergonomic work posture with a bent back position with an angle of 60° can cause discomfort and pain in the muscles with a relatively long period of 7 hours per day, it is because when doing drawing activities when looking at the image object on too upward or tilted facing the image object for a long time with high concentration to see the details of the object to be drawn. As well as student work facilities inside classrooms some are not properly functioned so prefer drawing on the classroom floor. The possibility of class facilities have not been adapted to the anthropometry of the students, so this is not in accordance with the opinion [22] that when work posture is designed to occur naturally so that it can reduce the incidence of musculoskeletal injury. There are respondents with symptom of low risk 24.24% this may be due to adolescent age, fit body condition, normal BMI, male, or body position when drawing with natural and correct posture.

The average of symptom of high risk MSDs symptom as a whole respondents with an average of 40.7 ° 5.3, this is in accordance [23] that symptom of pain in the upper body or head consisting of pain in the upper neck is 2.80%, and pain in the lower neck is 3.48%. symptom of pain in the left hand is equal to (3.61%) and the right hand is equal to (5.48%) this is caused because the work requires both hands. As well as the occurrence of spasms in the muscles around the neck, back, waist, and so on due to the muscles maintain a working position for a long time. This is in line with the research [24] that workers MSDs symptom are due to the fact that when working the body is in a static position.

MSDs symptom assessment of respondents in Picture 1 shows that the highest symptom on the right wrist (87%) and waist (81%) this is because drawing or painting activities require special skills, accuracy, and full concentration using both one hand and both hands. Drawing or painting can use one or two hands, if using one hand the painter only holds a color brush, while if using two hands, the other hand is used to hold the color paint palette [25].

In addition to concentration, drawing or painting in a static position for a long duration of work will lead to musculoskeletal symptom. The occurrence of spasms in the muscles around the neck, back, waist, and so on due to the muscles maintain a working position for a long time. This is in line with research conducted by Utari, Kalsum & Mahyuni which states

that musculoskeletal symptom in workers due to the work of the body is in a static position [24].

This is appropriate according to Tjahayuningtyas [26] that posture is not ergonomic, not fitting the anthropometry of workers to the workplace can cause problems in the musculoskeletal system, including joints and muscles. Reinforced by research Ahmad Rifqi fuady [19] which obtained the results of most craftsmen experience symptom of MSDs at the waist (14.02%), upper neck (8.88%) and right shoulder (8.88%). For the level of severe symptom (18.75 %) and mild symptom (13.95%) most common in the waist.

Symptom are highest on the right wrist and waist because students are right-handed and many working postures are not in natural conditions when sitting in class chairs. If these activities are carried out repeatedly and continuously and do monotonous work, it will cause interference with the muscles of the body. Physical stress can also affect muscle performance, because stress causes a health disorder of the body known as Musculoskeletal fatigue [20].

In workers who have a long period of work and by doing work that repeats the same movement, it will cause pressure on the part that experiences continuous movement [27]. Part of the body that many students complain about with a sitting position is on the neck, waist, back and buttocks. In order to avoid fatigue and muscle pain, the sitting position must be supported by the back of the chair. In addition, when sitting, the legs must also be supported. The design of workstations with students should also be considered [28].

The results of statistical tests using Pearson Product Moment test showed a value of $p = 0.000$ with a correlation value of $r = 0.507$ means that there is a relationship between the work duration with MSDs symptom. Based on previous research [29] workers who had a work life of 11-15 years and ≥ 16 years experienced a higher risk of musculoskeletal disorder symptom than workers with a working life of < 11 years. This is also in line with the research [30] states that the working period has a strong relationship with muscle symptom.

Extending the duration of work more than usual can cause a decrease in work efficiency but it can be a trigger for work fatigue, occupational diseases and even accidents. Physiologically, work breaks are needed to maintain productivity and work capacity [31] the longer the individual's working life, the longer the exposure to activities and types of activities carried out by workers, which can cause various kinds of physical symptom due to work performed every day repeatedly [32].

The results of statistical tests using Pearson product Moment test showed a value of $p = 0.000$ with a correlation value of $r = 0.637$ means that there is a relationship between work posture with MSDs symptom. According to research [33] shows that the working posture of standing for a long time causes clumping of venous blood vessels, because blood flow is opposite to the force of gravity. Non-ergonomic posture, non-compliance of the worker's anthropometry with the workplace can cause problems with the musculoskeletal system, including joints and muscles [26].

The research [7] with the research results, there is a relationship between work posture and symptom of MSDs in workers at CV. Sada revelation with a p -value of 0.033. And confirmed by Sheren Maria [34] that the results showed work posture has a relationship with symptom of musculoskeletal disorders ($p=0.024$). The results also match the statement Tarwaka unnatural working posture can occur because the workplace is less supportive of anthropometric workers. Workers who work in an inclined position and stand for a long time can cause musculoskeletal disorders [2].

The relationship of work duration, work posture with MSDs symptom was tested with multiple linear regression test to obtain results of 55.1% of work duration and work posture affect the occurrence of MSDs symptom. This is because respondents have a point of view from various sides of the object when going to draw or paint, especially if the picture is not finished. Respondents concentrate more on completing their paintings before the inspiration for their paintings is gone, so they often do not follow the set working hours. According to

the results of research states that the work with long sitting static 91-300 minutes proved to be a risk factor for the occurrence of back pain which is one of the musculoskeletal symptom [35, 36].

Respondents who are focused on their work, tend to maintain a sitting position, this causes stiffness of the muscles around the back of the body. According to research, The Painter's skill is highly dependent on the agility of the wrist movement when applying pencils, markers and color brushes. When painting there are repetitive movements on the wrist, this will trigger musculoskeletal symptom [25].

Research data shows that student posture does not naturally cause MSDs symptom, this is not in accordance with normal working posture that should be applied:

1. On the hand and wrist: in a straight line with the middle finger, not tilted or flexed or extended.
2. On the neck: be in a straight state and do not tilt/rotate to the left or right side. Tilt position on the neck does not exceed 20° so that there is no emphasis on the cervical disc

Therefore, the longer a person maintains his posture while working, the greater the risk of symptom of muscle pain felt [37].

5 Conclusion

Statistical test results showed that there is a relationship between the work duration and work posture with MSDs symptom (0.000) with results as much as 55.1% of the duration of work and work posture affect the occurrence of MSDs symptom.

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